

A REVISION OF THE UTAH SPECIES OF TOWNSENDIA (COMPOSITAE)

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In 1957, Beaman published his monumental and classical monograph on the genus *Townsendia* Hook. (Compositae, Astereae) which has become a model for several recent taxonomic studies. Beaman commented on several occasions that a critical lack of specimens hindered his research on a few of the species restricted to, or commonly associated with, the Utah flora. With the discovery of a new species in this genus by Welsh and Reveal (1968), it became obvious that since 1957 a great deal of new material had come into herbaria from this area, and with my location at that time at Brigham Young University, it was felt that a revision of the genus was not only in order but could be easily supplemented by additional field work both by myself and my associates at the University.

This revision is based, to a large degree, on Beaman's monograph. I have attempted to supplement his study not only by an examination of newer material, but also by a reexamination of many of the specimens studied by Beaman as well. I have assumed that his concepts of the taxa with regards to their typification is correct although it is necessary now to typify a few names not handled by him in accordance with the International Code of Botanical Nomenclature (Lanjouw, 1966).

I would like to acknowledge the assistance of Dr. Stanley L. Welsh, Curator of the Herbarium, Brigham Young University, who arranged for me to see material from the following herbaria.

A	Arnold Arboretum, Harvard University, Cambridge, Massachusetts.
BRY	Brigham Young University, Provo, Utah.
CAS	California Academy of Sciences, San Francisco, California.
DS	Dudley Herbarium, Stanford University, Stanford, California.
GH	Gray Herbarium, Harvard University, Cambridge, Massachusetts.
MO	Missouri Botanical Garden, St. Louis, Missouri.
MSC	Michigan State University, East Lansing, Michigan.
NA	United States National Arboretum, Washington, D.C.
NY	New York Botanical Garden, Bronx Park, Bronx, New York.
POM	Pomona College Herbarium, Rancho Santa Ana Botanic Garden, Claremont, California.
RSA	Rancho Santa Ana Botanic Garden, Claremont, California.
UC	University of California, Berkeley, California.
US	United States National Herbarium, Smithsonian Institution, Washington, D.C.
UT	University of Utah, Salt Lake City, Utah.
UTC	Intermountain Herbarium, Utah State University, Logan, Utah.

Specimens cited from other herbaria in discussing type material is taken from Beaman's paper in order to make the type citations

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complete. It should be noted, however, that type material from all of the above herbaria was seen in this study.

I would like to thank Dr. Stanley L. Welsh for reviewing this paper.

TOWNSENDIA IN UTAH

The members of the genus *Townsendia* are small and inconspicuous in the Utah flora. They occur among pinyon-juniper and sagebrush early in the spring of the year; later in the year, *Townsendia* flowers on high alpine ridges and slopes in the mountains where it is difficult to collect as well as find. Sereno Watson, with the King expedition in 1868, was the first collector to discover species of this genus in Utah, although to the north in Wyoming, Thomas Nuttall had found several of our species during his trans-continental trip in 1834. Lester Ward, a plant collector hired by John Wesley Powell, gathered specimens in southern Utah in 1875, but in Utah the most active collector of *Townsendia* was Marcus E. Jones. In the last fifty years a great many botanists have been collecting *Townsendia*: P. A. Rydberg, A. O. Garrett, W. P. Cottam, B. F. Harrison, and B. Maguire were early collectors who actively botanized in the state. They were followed by A. H. Holmgren, D. W. Ripley and R. C. Barneby, A. Eastwood and J. T. Howell, J. H. Beaman, S. L. Welsh, L. C. Higgins, N. D. Atwood and J. L. Reveal. All of these people have added many new collections to the various herbaria, and many of these more recent specimens were not available to Beaman.

The genus is primarily found in the Rocky Mountains of the United States. The species extend from the southern part of the Yukon to the central part of Mexico, and from the Columbia River Plateau of central Oregon and Washington to the Great Plains in northeastern Nebraska. Beaman (1957) recognized twenty-one species in the genus, but from the present study, I would recognize twenty-four, with Utah having more species (twelve) than any other state.

Narrow endemism is a common feature in the genus. In many instances, such as in *Astragalus* (Barneby, 1964) and *Eriogonum* (Reveal, 1969), edaphic factors have played a major role in speciation. I agree with Beaman (1957, p. 10) when he wrote: ". . . it may be stated that the acaulescent, rosulate forms require more highly specialized edaphic situations than do the caulescent types." *Townsendia aprica*, *montana*, *minima*, *mensana*, and *jonesii* are all highly specialized in particular edaphic situations in Utah while the remaining species of Utah *Townsendia* are generally found in a wider variety of habitats and on a great range of soil types.

The species concept in *Townsendia* is complicated by two rather intricate and possibly related problems—hybridization and apomixis. That both occur in a single species does not reduce the taxonomic status of the species, nor does the fact that the various species tend to overlap in flowering time reduce the possibilities of recognition of species. Even so, for the most part, the degree of hybridization is limited and hybrids do not seem to occur over large geographical regions so that no question of specific distinctiveness needs to be

raised. The fact that no possible hybridization can occur due to some taxa's geographical isolation has caused me to elevate two varieties recognized by Beaman to the species rank as they express a far greater degree of morphological difference than that found in other variants in the genus. In both cases, it is possible to demonstrate a distinction in morphology as well as edaphic and geographical isolation—features which as Cronquist (1968) has stated allows for the recognition of a species as “. . .the smallest population which is permanently (in terms of human time) distinct and distinguishable from all others.”

The role of apomixis has been discussed at great length by Beaman (1957). He points out that in the long-lived, high montane species, they are nearly always apomictic, and in many cases are nearly identical so that the various species may be extremely difficult to distinguish even by the experts. It is suggested that the user of this key to the species be keenly aware of both the morphology and the geographical location of his unknown plant.

The morphological characteristics used to distinguish species in the Utah *Townsendia* are not unique, but rather those frequently used in Compositae. The plants from Utah may be spreading annuals or biennials or highly reduced and compacted perennials. The roots are thick and woody in the perennials, but thinner in the annual plants; all have taproots. The caudices are branched, more or less woody, and often invested with old leaf-bases. The variation in leaf-shape in the genus is of little help in distinguishing species except for the fact that the leaf shape can separate large groups of species. There is a gradual modification of the blade into the petiole, with the variously pubescent leaf-bases clasping the stems. The margins of the leaves are entire; however, the degree of revoluteness varies between and within some species. In general, thickened leaves are found in the plants of higher elevations. Stem and leaf pubescence is essentially strigose and the amount of pubescences is an important taxonomic criteria. The involucre are campanulate to obconical with the phyllaries varying in both length-width ratio and the amount of pubescence. The margins of the phyllaries are usually ciliated.

The color of the ray-flowers vary from white to pink or blue except in *Townsendia aprica* which has distinctly yellowish rays (the rays of *T. jonesii* may dry yellowish on some plants). The adaxial surface is glabrous, but the abaxial surface varies from glabrous to densely glandular. The disk-flowers are yellowish except for the tips which may be reddish to purplish or greenish tinged. Achene shape and pubescence are important taxonomic features in the genus. The shape varies from narrowly oblanceolate to obovate and they are variously compressed with ribbed or callous-thickened margins. The pappus has been widely used in the genus as a key character, but it seems to be of limited value except in separating major groups of species. The length of the ray and disk pappus may be equal or different in the same species although it is not too uncommon to find

some diversity in a single plant. The bristles are always free on the disk-flowers, but they may be connate on the rays so as to become a ring of coroniform squamellae around the apex of the achenes.

SYSTEMATIC TREATMENT

Townsendia Hook., Fl. Bor.—Am. 2: 16, pl. 119, 1834.

Annuals or fore frequently biennials or perennials, caulescent or acaulescent herbs from taproots, these terminated by suberect, decumbent or rosulate woody caudices; leaves alternate, spatulate to linear, entire, glabrate to densely pubescent with few- to many-celled trichomes; heads pedunculate or terminal on stems or sessile and submerged in tufts of basal leaves; involucre campanulate to obconical, the phyllaries imbricated in 3-7 series, linear to obovate, ciliated along the margins, glabrous to pubescent; ray-florets pistillate, fertile, uniseriate, mostly 13-40, the ray-corollas broadly linear to oblong-linear, blue, whitish, pink, or yellowish on the adaxial surface, darker on the abaxial surface, glabrous or glandular; disk-florets hermaphroditic, numerous, the disk-corollas yellow and frequently pink- or purplish-tipped or tinged, glabrous or slightly glandular; achenes oblanceolate to obovate, compressed, 2-ribbed, glabrate or more frequently pubescent with simple, bifurcate hairs with prongs of an unequal length, or glochidiate with recurved prongs of essentially equal length; disk-pappus uniseriate of terete or obcompressed, plurisetose, barbellate bristles; ray-pappus similar to that of the disk or variously reduced or squamellae; $x=9$. Type species: *Aster excapa* Richards. [= *Townsendia excapa* (Richards.) Porter.] Named for David Townsend (1787-1858), an amateur botanist of West Chester, Pennsylvania, and a botanical associate of William Darlington.

KEY TO THE SPECIES

1. Plants long-lived perennials.
2. Phyllaries broadly lanceolate to ovate or elliptic, in 2-5 series.
3. Plants acaulescent, rosulate-pulvinate.
 4. Corolla-rays yellowish to golden-yellow, densely glandular on the abaxial surface; leaves strigose; rare, Sevier Co. 1. *T. aprica*
 4. Corolla-rays white, pink or blue, or if drying yellowish, then plants not from Sevier Co.
 5. Leaves linear, with dense tufts of long, simple trichomes at the base; Uinta Basin, Duchesne and Uintah cos. 4. *T. mensana*
 5. Leaves oblanceolate to spatulate.
 6. Achenes glabrous; leaves glabrous or only slightly strigose in some; high mountains in northern Utah above 9000 feet. 2. *T. montana*
 7. Achenial hairs simple or unevenly bifurcated with one prong exceeding the other, rarely truly glochidiate; leaves glabrous or sparsely strigose, thickened; Bryce Canyon area, Garfield Co. 3. *T. minima*
 7. Achenial hairs mainly glochidiate, rarely with scattered

unevenly pronged hairs in *T. jonesii*; leaves moderately to densely strigose.

8. Phyllaries glabrous or the outer ones only slightly pubescent; ray-corollas densely glandular; western Utah. 5. *T. jonesii*

8. Phyllaries conspicuously strigose; ray-corollas glabrous to lightly glandular; eastern and southwestern Utah. 10. *T. incana*

3. Plants caulescent with spreading-suberect stems; achenial hairs unevenly branched, not glochidiate; deserts of western Utah. 9. *T. florifer*

2. Phyllaries linear to narrowly lanceolate, in 5-7 series.

9. Phyllaries with a tuft of tangled cilia at the apex, linear, acuminate at the apex; leaves linear or narrowly oblanceolate, involute, sericeous-canescenscent; Carbon, Duchesne, and Daggett cos., rare. 7. *T. hookeri*

9. Phyllaries without a tuft of tangled cilia at the apex, narrowly lanceolate, acute at the apex.

10. Ray-corollas densely glandular on the abaxial surface; leaves linear with dense tufts of long, simple trichomes at the base; Uinta Basin, Uintah and Duchesne cos. 4. *T. mensana*

10. Ray-corollas glabrous or only sparsely pubescent.

11. Disk-pappus 3-6 mm long; leaf midveins not conspicuous; mountains of northern Utah. 6. *T. leptotes*

11. Disk - pappus 6-11 mm long; leaf midveins conspicuous; low mountains of southern Utah. 8. *T. exscapa*

1. Plants annuals or biennials.

12. Disk-pappus as long as or longer than the disk-corollas.

13. Achenial hairs unevenly branched, not glochidiate; plants caulescent with spreading-suberect stems; deserts of western Utah. 9. *T. florifer*

13. Achenial hairs glochidiate; eastern and southwestern Utah.

14. Stems among the leaves gray-white with a dense canescenscent pubescence; phyllaries strigose on the outer surface; eastern and southwestern Utah. 10. *T. incana*

14. Stems merely lightly to moderately strigose with the red stems among the leaves obvious; phyllaries moderately strigose on the outer ones, slightly so if at all on the inner ones; northeastern Utah. 11. *T. strigosa*

12. Disk-pappus shorter than the disk-corollas; phyllaries glabrous to moderately strigose-pilose, elliptical, obovate, or ovate to obtuse; southeastern Utah. 12. *T. annua*

DESCRIPTION OF THE SPECIES

1. *TOWNSENDIA APRICA* Welsh and Reveal

Townsendia aprica Welsh & Reveal, *Brittonia* 20: 375. 1968. Type: Ca. 6 mi S of Fremont Jct., Sevier Co., Utah, along Utah Hwy. 72, on low rolling gray clay slopes, among scattered igneous boulders, associated with *Juniperus* and *Castilleja*, at ca. 6500 ft.. 1 May 1966, *Reveal & Welsh* 721. Holotype, BRY! Isotypes, CAS, GH, MSC, NY, UC, US, UTC!

Rosulate-pulvinate caespitose perennial herbs from a much-branched partially subterranean caudex arising from a thin taproot,

the upper branches of the caudices often clothed with persistent leaf-bases usually bearing long white hairs, the plants 2-6 cm across, less than 2.5 cm high; leaves spatulate to oblanceolate, entire, the apex acute, minutely mucronate, strigose evenly or nearly so on both surfaces, tapering gradually to the leaf-base, the leaf-base 1-1.3 mm wide, essentially glabrous on the adaxial surface, with dense strigose erect-appressed hairs along the margin and abaxially, the broad leaf-base tapering toward the leaf-blade, the narrowest point being 3-6 mm above the point of attachment, 7-13 (16) mm long, (1) 1.5-3 (3.5) mm wide; peduncles lacking; involucre obconical at the base, 4-8 mm high, 7-13 mm wide; phyllaries in 3-4 series, lanceolate, the apex acute, fimbriated, red-scarious, the hyaline cilia numerous and densely arranged, glabrous adaxially, the outermost series occasionally sparsely strigose abaxially, otherwise glabrous, 5-7 mm long, 0.9-1.8 mm wide, the inner ones the longest; ray-florets 13-21; ray-corollas yellowish to golden adaxially, glabrous, reddish to rustic with yellowish margins abaxially, rather densely glandular throughout, the tube 1.8-2.9 mm long, greenish or rustic, sparsely glandular, the rays spreading to erect, 4-7 mm long, 0.8-2.2 mm wide; disk-corollas yellow, tinged with purple at the tip, 3.7-4.5 mm long; achenes narrowly oblanceolate, 2-2.5 mm long, 0.5-0.7 mm wide, compressed, 2-ribbed, nearly glabrous along the ribs, densely pubescent on the wide compressed surfaces with long tangled hyaline glochidiate hairs with the apex bifurcated into two recurved tips; pappus of the ray-flowers 0.7-1 mm long of about 15 plurisetose, barbellate bristles, these tending to be united at the base, occasionally with some individual bristles as short as 0.3 mm long on the same achene; pappus of the disk-flowers similar, only 4-5 mm long and free.

DISTRIBUTION: Known only from Sevier Co., Utah, on heavy clay soils. Flowering from April to May.

SPECIMENS EXAMINED: Sevier Co.: Ridge between Cottonwood and Willow creeks, 31 May 1940, *Robinette 105 L. R.* (NA); at Milepost 28.3 North of Fremont, Welsh, Atwood and Higgins 8972, 10 May 1969 (BRY).

The need for this revision was initiated mainly by the discovery of *Townsendia aprica* as it was necessary to investigate the related species in some detail before the exact nature of this new entity could be determined. As suggested by Welsh and Reveal (1968), *T. aprica* is related to both *T. minima* and *T. jonesii*. The leaves of *T. minima* are glabrous or nearly so with rounded apices on truly spatulate leaves. The leaves of *T. jonesii*, while pubescent as in *T. aprica*, are decidedly longer and much narrower than in *T. aprica*, and not at all glandular as in *T. aprica*. While the peduncles are obsolete in both *T. minima* and *T. aprica*, the peduncles of *T. jonesii* are often up to 3 cm long in some populations. The achene hairs of *T. minima* are bifurcated, while in *T. jonesii*, the hairs are glochidiate and only rarely are some bifurcate hairs seen. Apparently the hairs on the achenes in *T. aprica* are always glochidiate.

The most distinctive feature of *Townsendia aprica* is the presence of yellow or golden colored rays. This is a consistent feature of the species and is apparently a reflection of its genetic makeup instead of some type of artificial response—such as drying upon being pressed. In some populations of *T. jonesii*, a yellowish cast has been recorded, but the yellowishness is dull and is not seen in the field. Until *T. aprica* was discovered, yellow rays were unknown in the genus and in using present floras of the state (Rydberg, 1917; Tidestrom, 1925; Welsh, et al. 1964), it is impossible to key this species to the genus *Townsendia*.

2. TOWNSENDIA MONTANA M. E. Jones

Townsendia montana M. E. Jones, Zoe 4: 262. 1893. Type: Above the Flagstaff Mine at Alta, 9500 ft elev, Salt Lake Co., Utah, 7 Aug 1879, M. E. Jones s.n. Holotype, POM!

Townsendia alpigena Piper, Bull. Torrey Bot. Club 27:394. 1900. Type: Subalpine ridges of the Wallowa Mountains, 7000 ft elev, Wallowa Co., Oregon, 31 Jul 1899, *Cusick 2294*. Holotype, WS! Isotypes, F. GH. MO, MSC. UC. US! Lectotype selected by Beaman (1957).

Townsendia dejecta A. Nels., Bot. Gaz. 37: 267. 1904. Type: Dyer Mine, Uinta Mountains, ca. 9000 ft elev, Uintah Co., Utah. 3 Jul 1902, *Goodding 1238*. Holotype. RM. Isotypes. MO. US!

Rosulate-pulvinate caespitose perennial herbs from a much-branched, relatively elongated, subterranean woody caudex arising from a woody taproot, the upper branches of the caudices usually lacking persistent leaf-bases but with persistent leaf-scars on the naked older branches, the plants up to 10 cm across and 4 cm high; leaves spatulate to broadly elliptical, entire, the apex obtuse to acute, not mucronate, nearly or quite glabrous except on the youngest leaves, these often sparsely strigose, tapering gradually to the leaf-base, the leaf-base 0.8-1.5 mm wide, often sparsely strigose along the margins and anthrocynsis, the petiole 0.8-2.6 mm long, the leaf-blades 4-12 (15) mm long, 2.5-3.2 (5) mm wide; peduncles present, scapose or nearly so, enlarged at the junction with the head, pilose-strigose, 6-35 mm long; involucre obconical at the base, 7-11 mm high, 9-15 mm across; phyllaries in 3-6, mostly 4, series, oblong to obovate, obtuse and rounded at the apex, with red-scarious ciliated margins, glabrous or with a few scattered strigose hairs on the outer phyllaries on the abaxial surface, 3-8 mm long, 1.9-3.2 mm wide, the inner ones the longest; ray-florets 13-21; ray corollas white or dark blue, glabrous or sparsely glandular on the abaxial surface, the rays 6-9 mm long, 1-3.5 mm wide, the tubes 2-3 mm long, yellowish; disk-corollas yellow, tinged with green at the tip, 3-5 mm long; achenes oblanceolate, compressed, 2-ribbed, those of the rays rarely 3-ribbed, glabrous or with a few glochidiate hairs at the extreme base, (2) 3-4.5 mm long, 1-1.5 mm wide; pappus of the ray-flowers

of about 15-30 plurisetose barbellate bristles, 3-5.5 mm long, free; disk-pappus similar to the ray-pappus. $2n = 18$ (Beaman, 1957).

DISTRIBUTIONS High mountains of western Montana and central Idaho southward through western Wyoming into central and northeastern Utah with an outlying population in northeastern Oregon. Flowering from (May) June to August.

REPRESENTATIVE SPECIMENS: Cache Co.: Saddle of Mt. Naomi, 22 Jul 1936, *Maguire et al. 14227* (UTC). Duchesne Co.: 14 mi S of Duchesne, 18 May 1908, *Jones s.n.* (POM). Juab Co.: N Peak, Mt. Nebo, 7 Jul 1959, *Cottam et al. 15577* (UT). Salt Lake Co.: Flagstaff Mine near Alta, 24 Jul 1954, *Beaman 843* (GH, MSC); Sunset Peak, 14 Jun 1960, *Cottam & Rowland 16152* (UT, UTC); Pioneer Peak, 22 Jun 1961, *Cottam & Rowland 16710* (UT); ridge between Sunset Peak and Devils Castle, 29 Jun 1961, *Cottam & Rowland 16771* (UT); head of Little Cottonwood Creek, 3 Jul 1905, *Rydberg 6607* (NY, US). San Pete Co.: Mt. Baldy, Wasatch Plateau, 16 Jul 1954, *Beaman 806* (GH, MSC, RSA, UTC); Horseshoe Mtn., Jul 1946, *Goodwin 46Jy3* (NA); head of Bacon Rhine Canyon, 22 Jul 1927, *Humphrey s.n.* (BRY); Mayfield Canyon, 8 Aug 1940, *Maguire 19987* (GH, NY, US, UTC). Summit Co.: divide between the E Fork of the Bear River and Black's Fork, 9-13 Jul 1930, *Goodman & Hitchcock 1517* (GH, NY, in part). Uintah Co.: White Rock Canyon, 17 Aug 1935, *Graham 10065* (NA).

Townsendia montana is found in the high mountains of Utah from Cache Co. in the north to the Wasatch Plateau of San Pete Co. in the south, and eastwardly into the Uinta Mountains of Summit and Uintah cos. This species is related to *T. eximia* A. Gray and *T. glabella* A. Gray, both of which are restricted to the mountains of Colorado and New Mexico.

In Utah, this species has essentially blue flowers and commonly grows in rocky or gravelly places on high mountain plateaus, ridges, or shallow soiled slopes. The populations are highly isolated and often individually distinct due to apomixis; however, the number of plants in any one population may be relatively large. The plants from the type area near Alta, for example, have wide, blue to dark blue rays on glabrous plants with dark green leaves. Those found on the Wasatch Plateau, on the other hand, have white to pink or light blue rays on plants that are not as dark green. The plants of northern Utah tend to be more compact and less elongated than those in central Utah. Members of this species are usually found intermixed among various grass species in the open places between clumps or even under clumps of the various forms of *Artemisia*, the sagebrushes.

Among the Utah species of *Townsendia*, *T. montana* can be rather easily distinguished by the blue rays which are glabrous to sparsely glandular and the glabrous achenes.

3. TOWNSENDIA MINIMA Eastw.

Townsendia minima Eastw., Leaflet West. Bot. 1: 206. 1936. *T. montana* var. *minima* (Eastw.) Beaman, Contr. Gray Herb. 183: 85. 1957. Type: Bryce Canyon, Garfield Co., Utah, 19 Jun 1933, *Eastwood & Howell 727*. Holotype, CAS!

Rosulate-pulvinate caespitose perennial herbs from a much-branched, elongated, subterranean caudex arising from a wood taproot, the upper branches of the caudices clothed with persistent leaf-bases for 1-5 cm so as not to expose the leaf-scars, the plants up to 15 cm across and 5 cm high; leaves narrowly spathulate or oblanceolate, entire, the apex obtuse or more commonly acute, often mucronate, thinly strigose (especially in young plants and on new growth) becoming glabrous or nearly so on the adaxial surface, (3) 4-8 mm long, 1.2-3 mm wide, the blades tapering gradually onto the petioles, these 5-9 mm long, strigose especially along the margins, the leaf-bases not often antrocyntosis; peduncles lacking; involucre obconical at the base, 6-10 mm across, 5-8 mm high; phyllaries in 3-4 series, oblanceolate, mostly acute at the apex, with red-scarious ciliated margins, strigose abaxially, 3-7 mm long, 0.9-2.1 mm wide, the inner ones the longest; ray-florets 13-21; ray-corollas pink to light blue, sparsely glandular on the abaxial surface, the rays 4-8 mm long, 1.5-2.1 mm wide, the tubes 1.8-2.5 mm long, pinkish; disk-corollas yellow, tinged pink to purplish at the tip, 3-4 mm long; achenes oblanceolate, compressed, 2-ribbed, those of the rays rarely 3-ribbed, long pubescent with fine unequally forked hairs, 2-3 mm long, 0.9-1.4 mm wide; pappus of the ray-flower of 15-30 plurisetose barbellate bristles, 3-5 mm long, rarely shortened, free; disk-pappus similar to the ray-pappus. $2n = 18$ (Beaman, 1957).

DISTRIBUTION: Endemic to the Red Canyon and Pink Cliffs area near and in Bryce Canyon, and southward to near Orderville, Garfield and Kane cos., Utah. Flowering from April to June.

REPRESENTATIVE SPECIMENS: Garfield Co.: 2 mi E of Jct. of U.S. Hwy. 89 and Utah Hwy. 54, 21 Jul 1954, *Beaman 823* (GH, MSC); S of garbage dump, Bryce Canyon, 8 Jun 1958, *Buchanan 349* (UT); above Tropic, 29 May 1894, *Jones 5312ar* (NY, POM, US); Paria River, Pink Cliffs, 25 Jun 1940, *Maguire 19099* (NY, UTC); 1 mi E of Pine Lake, Pink Cliffs, 26 Jun 1940, *Maguire 19120* (GH, NY, UTC); E fork of Sevier River, 3.5 mi S of Utah Hwy. 12, 25 May 1968, *Reveal & Reveal 1010* (BRY, US); low ridge N of E Fork of the Sevier River Road, N of Utah Hwy. 12, 25 May 1968, *Reveal & Reveal 1018* (BRY, US); top of ridge S of Red Canyon Campground, 25 May 1968, *Reveal & Reveal 1027* (BRY, US); do. *N. D. Atwood 1885* (BRY) 20 Jun 1869; NE of Widtsoe, 26 May 1968, *Reveal & Reveal 1035* (BRY, US); Red Canyon, 7 Jun 1947, *Ripley & Barneby 8540* (CAS, NY). Kane Co.: 15 mi NW of Orderville, 17 Jun 1940, *Maguire 18807* (UTC).

Townsendia minima was described as a distinct species by Eastwood in 1936, but reduced to a variety of *T. montana* by Beaman

some twenty years later. In the present paper, I am proposing that Eastwood's original desposition for the population be retained. I certainly agree with Beaman (1957) that this species is related to *T. montana*, but morphologically the two differ in leaf and achene pubescence, the size of the leaves, the degree of persistence of the leaf-bases and—for the most part—the color of the rays. The two species differ greatly in ecological and particularly in the type of soils on which they grow. *Townsendia minima* occurs at lower elevations than *T. montana*, in open exposed sites on heavy soils of the Wasatch Formation. This combination of features has led me to consider the two entities as distinct species.

This species is common in Red Canyon, a well known area for its interesting botanical endemics. The canyon, part of the Dixie National Forest, is now heavily used by recreation visitors, and is in danger of being so over-used that these unique and usually exceedingly rare species may be lost. *Eriogonum aretioides* Barneby is known from only a few plants in about three scattered locations. *Silene petersonii* Maguire and *Townsendia minima* are only occasionally found as is *Lesquerella rubicundula* Rollins and the recently described *Cryptantha ochroleuca* (Higgins, 1968). *Oxytropis jonesii* Barneby is locally encountered, but it is never abundant. These interesting species, all of which occur on the lower slopes and in the bottom of the canyon, are often subjected to destruction by nature as well as by man, and some control of the Red Canyon area will have to be made if this canyon is to remain a pleasant and attractive recreation site.

4. TOWNSENDIA MENSANA M. E. Jones

Townsendia mensana M. E. Jones, Contr. West. Bot. 13: 15 1910. Type: Benches of the Uintas near Duchesne [then called Theodore], at about 7500 ft elev, Duchesne Co., Utah. 14 May 1908. M. E. Jones s.n. Holotype, POM!

Rosulate-pulvinate caespitose perennial herbs from a much-branched short, woody subterranean caudex arising from a well-developed woody taproot, the upper branches of the caudices often clothed with persistent leaf-bases, the plants up to 1 cm across and 5 cm high; leaves narrowly oblanceolate to linear, entire, the apex acute, mucronate, evenly strigose on both surfaces, involute, (4) 6-14 mm long, 0.8-1.3 mm wide, the blades tapering imperceptibly to the leaf-base, the abaxial surface of the leaf-base densely woolly with long, white, multicellular trichomes; peduncles lacking; involucre obconical at the base, 6-9.5 mm across, 5-9 mm high; phyllaries in 4-5 series, lanceolate, acute at the apex, margins ciliated, green and glabrous to sparsely glandular or lightly strigose-pilose on the outer surface, 3.5-8 mm long, 1.2-1.8 mm wide, the longer inner ones often reflexed; ray-florets 13-21; ray-corollas whitish or pinkish, often with pale pinkish streaks and fine brownish lines abaxially, glandular on the abaxial surface, the rays 5-7.5 mm long, 0.9-1.4 mm wide, the tubes 3-3.8 mm long, whitish; disk-corollas

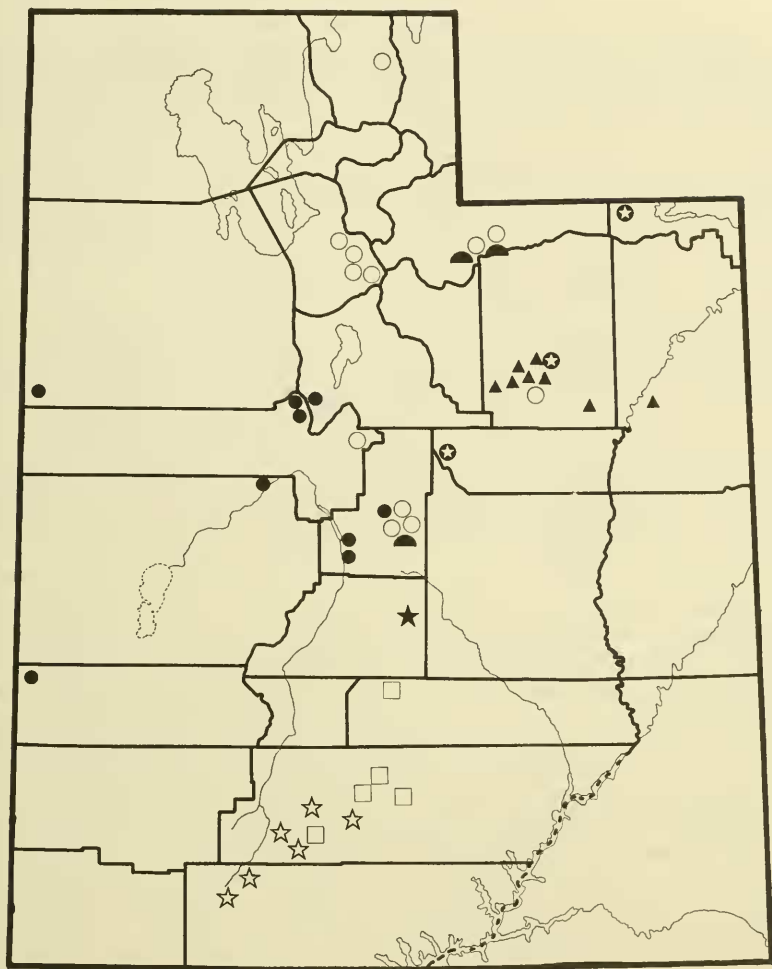


Fig. 1. Distribution of *Townsendia aprica* (star); *T. montana* (open circles); *T. minima* (open stars); *T. mensana* (triangles); *T. jonesii* (closed circles); *T. leptodes* (half circles); *T. hookeri* (circles with star in center); and *T. exscapa* (squares).

yellow, often tinged pink at the tip, 3.5-4.8 mm long; achenes ob-lanceolate, compressed, 2-ribbed, densely pubescent on all surfaces with glochidiate hairs; pappus of the ray-flowers of 15-35 plurise-tose barbellate bristles, 2.5-4 mm long, free; disk-pappus similar to the ray pappus only 5-6.5 mm long.

DISTRIBUTION: Endemic to the Uinta Basin of northeastern Utah in Duchesne and Uintah counties mainly on pinyon-juniper mesas in rocky places. Flowering from late April to June.

SPECIMENS EXAMINED: Duchesne Co.: 26 mi SW of Myton, 15 May 1955, *Barneby 12701* (CAS); 15 mi W of Duchesne, 29 Jul 1954, *Beaman 865* (GH); 3 mi SW of Duchesne, 30 Jul 1954, *Beaman, 866* (GH); 11 mi N of Duchesne, 30 Jul 1954, *Beaman 868* (GH, MSC); 5 mi W of Duchesne, 26 Jul 1957, *Beaman & Stone 1447* (MSC); 19 mi W of Duchesne, 4 May 1968, *Reveal & Reveal 961* (BRY. US); 1.5 mi W of Jct. Utah Hwy 35 and ca. 8 mi N of Duchesne, 4 May 1968; *Reveal & Reveal 965* (BRY, US); 3 mi W of Duchesne, 30 May 1942. *Ripley & Barneby 4677* (CAS). Uintah Co.: Between Hill Creek and Green River, ca. 20 mi S of Ouray, Jun 1955. *Bartholomew & Bartholomew s.n.* (GH).

Townsendia mensana is a rare and local species endemic to the Uinta Basin of northeastern Utah. In the Duchesne area, where most of the collections have been made, the species occurs on the low pinyon-juniper "benches" or mesas where the low stature and the pale color of the plants easily blend into the ground. The single collection made in Uintah County was taken from white shale slopes of the Green River Formation in the Hill Creek area. This latter population differs only slightly from those taken from the gravelly soils; however, additional collections from Hill Creek would be desirable.

During the spring of 1968, I found this species in several locations, but all essentially around the Duchesne area. In most places this species is found growing in association with *Cryptantha nana* Eastw., *Phlox hoodii* Rich., *Oxytropis sericea* Pursh var. *sericea* A. Gray, and *Eriogonum tumulosum* (Barneby) Reveal under *Pinus edulis*, *Engelm.*, and *Juniperus osteosperma* (Torr.) Little. Most often the plants of the *Townsendia* are found in open areas among the various plants mentioned above, but almost always on heavy clay or rocky soils. The populations examined north of Duchesne grew on loose gravelly soil and on a cobble stone soil derived from a river bed. One population three miles west of Duchesne is on an exposed clay ridge similar to that found at the type locality of *Lepidium barneybyanum* Reveal (1967) where it is associated with both *Eriogonum batemanii* M. E. Jones and *E. tumulosum*, the *Oxytropis*, *Silene acaulis* L. ssp. *subacaulescens* (F. N. Will.) Hitchc. & Maguire, *Chamaechaenactis scaposa* (Eastw.) Rydb. var. *parva* Preece & Turner, and *Artemisia arbuscula* Nutt. var. *nova* (A. Nels.) Cronq. Further to the west, *T. mensana* is found on an exposed clay outcrop which is less than five feet high, about ten to thirty feet wide, and perhaps six hundred feet long. Here the *Townsendia* is found associated with the *Cryptantha* and the *Phlox*, a species of *Lesquerella*, and *Pediastrum alpinum* (Nutt.) A. Gray var. *ligulatum* M. E. Jones. As can be seen, in nearly all cases where *T. mensana* is found, it is growing with a rather unique series of species.

In the past, *Townsendia mensana* has been confused with what is now called *T. hookeri* Beaman, but what in turn was known in the literature prior to Cronquist (1955) and Beaman (1957) as *T. Sericea*. Cronquist pointed out that *T. sericea* was a synonym of *T.*

exscapa and took up the name *T. mensana* for those plants. It was not until Beaman was able to study the type of *T. mensana* that it was realized that this species was highly restricted and a plant (ie. *T. hookeri*) which has been known for more than a century to numerous taxonomists was actually unnamed.

Townsendia mensana may be distinguished from *T. jonesii*, its nearest relative, by its narrow leaves and phyllaries, and the sessile flowering heads.

5. TOWNSENDIA JONESII (Beaman) Reveal

Townsendia jonesii (Beaman) Reveal, stat. & comb. nov, based on *T. mensana* M. E. Jones var. *jonesii* Beaman, Contr. Gray Herb. 183: 88. 1957. Type: Mammoth, 7000 ft elev, Juab Co., Utah. 10 May 1910, *M. E. Jones s.n.* Holotype. POM!

Rosulate-pulvinate caespitose perennial herbs from a much-branched, short, or more commonly long, woody subterranean caudex arising from a well-developed taproot, the upper branches of the caudices often clothed with persistent leaf-bases, the plants up to 3 cm high and 10 cm across; leaves narrowly oblanceolate to narrowly spatulate, entire, the apex mostly acuminate, mucronate, moderately strigose on both surfaces, plane or infrequently involute. (1) 1.8-3:5 (4) cm long, 1-2.5 (4) mm wide, the blades gradually tapering to the leaf-base, the abaxial surface of the leaf-base strigose; peduncles present, up to 3 cm long, strigose; involucre obconical at the base, 8-13 mm wide, 9-12.5 mm long; phyllaries in 4-5 series, lanceolate, mostly acute at the apex, margins ciliated, green or purplish nearly throughout, sparsely strigose in the middle of the outer surface, 4-10 mm long, 1-2 (2.5) mm wide, the longer inner ones erect; ray-florets 13-21; ray-corollas whitish to pink, often drying a dull yellow, occasionally with a darker streak abaxially, densely glandular on the abaxial surface, the rays 4-7 mm long, 1-2 mm wide, the tubes 2.5-4 mm long, light green to white; disk-corollas yellow, usually purplish tinged at the tip, 3.5 mm long; achenes oblanceolate, compressed, 2-ribbed, those of the ray-florets rarely 3-ribbed, 3-5.5 mm long, 0.8-1.8 mm wide. \pm densely pubescent on the faces with glochidiate hairs, these rarely intermixed with unequally pronged hairs toward the apex; pappus of the ray-flowers of 15-30 plurisetose, barbellate bristles, 2-4.5 mm long, free; pappus of the disk-flowers similar only 5-8 mm long.

DISTRIBUTION: Infrequent to rare in west-central Utah and adjacent extreme east-central Nevada, with an outlying series of populations in the Sheep Range and Charleston Mountains of Clark Co., Nevada. Flowering from March to June.

REPRESENTATIVE SPECIMENS: Beaver Co.: Top of Needle Ranges, 5 mi S of Mountain Home Spring, 31 May 1965, *R. Holmgren 458* (BRY). Juab Co.: McIntyre's Ranch, 18 May 1891, *Jones s.n.* (POM); Tintic Junction, 9 May 1910, *Jones s.n.* (POM). San Pete

Co.: 2 mi SE of Ephraim, 16 Jul 1954, *Beaman 820* (GH, MSC); 5 mi W of Fayette, 12 May 1962, *Jensen 546* (UTC); Gunnison, 7 Jun 1910, *Jones s.n.* (POM); 2.8 mi E of Ephraim, 18 May 1968, *Reveal & Reveal 1001* (BRY, US). Tooele Co.: Deep Creek, 6 Jun 1891, *M. E. Jones s.n.* (POM). Utah Co.: Mercur, 6 Jun 1896, *Jones s.n.* (MO, NY, POM, US, UTC).

Townsendia jonesii was first described by Beaman (1957) as a variety of *T. mensana* to which it is probably closely related. The elevation of this western Utah taxon to the specific rank comes as a result of recent field and herbarium studies carried out in the spring seasons of 1967 and 1968. In general, *T. mensana* is a low, inconspicuous plant with sessile heads, linear leaves with dense tufts of hairs at the base, and the lanceolate phyllaries. *Townsendia jonesii*, on the other hand, is usually not so low or inconspicuous, and generally the heads are peduncled, with wider and longer leaves which are much less pubescent at the leaf-bases, and broadly lanceolate to narrowly obovate phyllaries. Ecologically the two species are somewhat similar, although *T. jonesii* is more frequently found in areas among *Artemisia tridentata* Nutt. and on more sandy soils than *T. mensana*.

The geographical separation of these two species makes them distinctive too. The western desert regions of Utah have several plants that have closely related forms in the Uinta Basin. Some examples are in such genera as *Astragalus*, *Penstemon*, and *Eriogonum*; and, in nearly all cases, the taxa are separated at the specific level. While it is obvious that the two species of *Townsendia* are related, *T. jonesii* seems to form hybrids with *T. florifer* (Beaman, 1957). However, this hybridization does not seem to destroy the specific distinction between the two supposed parents.

During the course of this study, several attempts have been made to rediscover *Townsendia jonesii* in its type locality. The species was not found. The entire area around Eureka, Mammoth, and Tintic has greatly changed over the years since Jones visited these mining communities. Dr. S. L. Welsh has studied the flora in the Tintic area with a great deal of concentration on finding plants named by Jones from this area. However, the *Townsendia* has eluded him too. I. E. Diehl, who lived at Mammoth and actively collected plants in the area apparently did not find the species either, or at least a specimen of his is not among his personal collection deposited at Brigham Young University or in the Jones collection now found at the Rancho Santa Ana Botanic Garden. Certainly, *T. jonesii* must be in the area, but where still remains to be discovered.

Both Heiser (1948) and Beaman (1957) were puzzled by the plants from the high mountains of Southern Nevada. In the herbarium, Heiser decided to distinguish the southern Nevada plants as a distinct species, but shortly afterwards called the plants *T. arizonica*, a synonym of *T. incana*. Beaman recognized the difference between the Utah and Nevada populations of his var. *jonesii*, but decided at that time not to attempt to make a taxonomic distinction

between the two. During this study, it has been possible to note additional morphological characters as well as ecological differences that point out the distinctiveness of the southern Nevada plants. However, these differences do not seem to be great enough to merit specific recognition, and thus may be called:

TOWNSENDIA JONESII (Beaman) Reveal var. TUMULOSA Reveal

Townsendia jonesii (Beaman) Reveal var. *tumulosa* Reveal, var. nov. Type: Ca. 1 mi N of Deer Creek along the Hwy. toward Lee Canyon on gravelly limestone slopes associated with *Abies* and *Pinus*, 8400 ft elev, sec. 8, T. 19 S., R. 57 E., Charleston Mountains, Clark Co., Nevada, 17 Jun 1968, *Reveal 1326*. Holotype, BRY! Isotypes, NTS, NY, UTC!

A var. *jonesii* differt folis 1-2 (2.5) cm longis, (2) 2.5-3.8 (4.2) mm latis, capitulis pedunculatis usque ad 1.5 cm longis, phyllaris late lanceolatis vel obovatis. obtusis, 1.8-3 mm latis.

Herbae perennes, rosulatae-pulvinatae, caudicibus ramosis parte subterraneis partim e radice gracili; plantae 2-10 cm latae, minus quam 3 cm altae; folia spathulata vel late oblanceolata, integra, \pm uniformiter strigosa supra et subtus, raro glabra supra 1-2 (2.5) cm longa, (2) 2.5-3.8 (4.2) mm lata; pedunculi usque ad 1.5 cm longi; involucria (7) 8-12 (14) mm lata, 8-10.5 mm alta, obconica; phyllaria 4-5 seriata, late lanceolata vel obovata, apice obtusa, apice obtusa, fimbriata, scariosi-marginata, cilis numerosis, supra glabra vel apice strigosa, 4-9 mm longa, 1.8-3 mm lata; corollae radii ca. 13-21, ligulis 5-7 mm longis, 0.8-1.3 mm latis, supra albis vel rosis et glabris, subtus rubellis ad rubiginosis, aliquantum ubique dense glanduliferis, tubo 2.8-4 mm longo, albo; corollae disci flavae, purpurascenti-tinctae, 4.5-6 mm longae; achenia oblanceolata, 3-5 mm longa, 0.8-1.5 mm lata, compressa, pubescentia; pappus flosculorum radiorum 3-4.5 mm longorum; pappus flosculorum discorum 6-7 mm longorum, setis basaliter libris.

DISTRIBUTION: Upper slopes of the Sheep Range and Charleston Mountains from about 6900 ft elev to nearly 10,000 ft elev, Clark Co., Nevada. Flowering from March to June.

SPECIMENS EXAMINED: NEVADA: Clark Co.: Deed Creek, Charleston Mts., 13 June 1939, *Alexander 774* (UC); between Deer Creek and Kyle Canyon, Charleston Mts., 17 June *Alexander 780* (UC); Hidden Forest, Sheep Range, 25 May 1940, *Alexander & Kellogg 1558* (CAS, NA, UC); S slope of Hayford Peak, Sheep Range, 27 May 1940, *Alexander & Kellogg 1568* (NA, UC); Hayford Peak, Sheep Range, 7 Jun 1940, *Alexander & Kellogg 1676* (UC); S of Deer Creek, Charleston Mts., 4 Jun 1937, *Clokey 7772* (UC); Lee Canyon, Charleston Mts., 22 Jun 1937, *Clokey 7773* (UC); Clark Canyon, Charleston Mts., 24 Mar 1934, *Jaeger s.n.* (POM); 5 mi NE of Charleston Peak, Charleston Mts., 21 Jun 1937, *La Rivers & Hancock 487* (NA); Hidden Forest, Sheep Range, 13 Jun 1968, *Reveal 1283* (NTS, NY, UTC); Lee Canyon, Charleston Mts., 11

Apr 1939, *Ripley & Barneby 2910* (UC); head of Deadman Creek, Sheep Range, 19 May 1938, *Train 1777* (NA).

The var. *tumulosa* is rather distinct in the field, and much more common than any of the known sites of var. *jonesii*. It occurs on loose sandy slopes usually under *Pinus ponderosa* Dougl. ex Laws.. and is frequently associated with *Artemisia*. However, unlike most of the populations of var. *jonesii*, the var. *tumulosa* occurs in open and exposed places where the surrounding shrubs or even herbaceous perennials afford little or no protection. One may speculate that this is due to the higher altitude at which this new variety occurs, but such judgements have little documentation.

6. TOWNSENDIA LEPTOTES (A. Gray) Osterh.

Townsendia sericea Hook. var. *leptotes* A. Gray, Proc. Amer. Acad. 16: 85. 1880. *T. leptotes* (A. Gray) Osterh., Muhl. 4: 69. 1908, as *leptotes*. Type: Middle Park, Grand Co. (?), Colorado, Jul-Aug. 1864, *Parry s.n.* Holotype, GH! Isotypes, F, MO, NY, PH. UC, US, YU!

Rosulate-pulvinate caespitose perennial herbs from a much-branched, short, woody subteranean caudex arising from a well-developed tap-root, the upper branches of the caudices often clothed with persistent leaf-bases and terminated by tufts of leaves. the plants up to 4 cm high and 10 cm across; leaves linear to oblanceolate or narrowly spatulate, entire, the apex acute, mucronate, moderately strigose-sericeous, especially so on the margins, becoming less so on the blades, often involute, 1-3 (4) cm long, 1.3-2.6 mm wide, the leaf-blades tapering imperceptibly to the leaf-base, the anthrocynsis leaf-bases strigose abaxially, slightly less so to glabrous on the adaxial surface; peduncles lacking; involucre campanulate at the base, 0.9-1.4 cm wide, 0.5-1 cm high; phyllaries in 4-7 series, lanceolate to nearly linear, acute at the apex, the margins ciliated and scarios, mostly reddish-purple, glabrous or with a few scattered hairs along the midrib, 3-9 mm long, 0.8-1.4 (1.8) mm wide, the inner ones the longest; ray-florets 13-34; ray-corollas whitish, cream, or pink, glabrous, the rays 6-10 mm long, 1.2-2 mm wide, the tubes 2.5-3 mm long, cream to tan; disk-corollas yellow, sometimes tinged with pink, 3-5 mm long; achenes oblanceolate, compressed, 2-ribbed, those of the rays rarely 3-ribbed, sparsely to moderately pubescent with long, fine, glochidiate hairs; pappus of the ray-corollas of 15-30 plurisetose, barbellate, bristles 3.5-6.5 mm long, sometimes exceedingly reduced in some to less than 1 mm long; pappus of the disk-corollas similar to the ray-corollas only not reduced. $2n=18$ (Beaman, 1957).

DISTRIBUTION: Widely-scattered and isolated in the high mountains of extreme southwestern Montana, northwestern Wyoming, and adjacent southeastern Idaho, southward into western Colorado and the extreme northern part of New Mexico, northeastern and central Utah, and westward across central Nevada in the Toiy-

abe and Toquima ranges to the White Mountains of extreme east-central California. Flowering May to August.

REPRESENTATIVE SPECIMENS: Summit Co.: divide between E Fork of the Bear River and Black's Creek, Uinta Mts., 27 Jul 1957, *Beaman & Stone 1446* (MSC); divide between E Fork of the Bear River and Black's Fork, Uinta Mts., 9-13 July 1930, *Goodman & Hitchcock 1517* (CAS, DS, GH in part MO, NY in part, PH, RM, UC). Sanpete Co.: Spring Hollow drainage above the Great Basin Experiment Station, 12 Jun 1948, *Holmgren & Shaw 7640* (CAS, MO, NY, POM, UC, US, UTC).

Townsendia leptotes is a species of wide geographical range and capable of occupying a variety of montane ecological niches. This feature of the species might be appreciated by the phytogeographer and the taxonomist were it not for the fact that this taxon exhibits the greatest amount of variation in the genus. The variation is expressed in terms of almost every extreme, but none of them is subject to any kind of geographical or ecological pattern, and to make matters worst, unduly amounts of variation may be noted in geographical adjacent populations. In Utah, from the data gathered to date, the amount of variation does not seem to be as extensive as found elsewhere. This is due primarily to the small number of known sites where the species occurs in Utah, the almost total apomictic nature of the Utah plants, and the apparent lack of hybridization. Even so, the two major populations of Utah plants do not seem to be too closely related. According to Beaman (1957), the plants from the Uinta Mountains are similar to some populations found in southwestern Colorado and in central Idaho. On the other hand, the plants from the Wasatch Plateau are similar to those found in the high mountains of central Nevada and extreme east-central California. Throughout the range of *T. leptotes* it forms hybrids with *T. exscapa*, but not in Utah as the two do not grow together. Perhaps, it is for this reason that populations of *T. leptotes* are not too difficult in Utah.

7. TOWNSENDIA HOOKERI Beaman

Townsendia hookeri Beaman, Contr. Gray Herb. 183: 95. 1957. Type: Dry hills in Mt. Vernon Canyon, 1730 m elev, Jefferson Co., Colorado 13 Apr 1920. *Clokey 4338*. Holotype, COLO. Isotypes, CAN, CAS, DS, F, GH, MICH, MO, MONTU, NA, PH, POM, RM, UC, US, UTC, WS, WTU!

Densely rosulate-pulvinate caespitose perennial herbs from short, numerous, subterranean, woody caudices arising from a heavily wooded taproot, the caudices densely invested in old persistent leaves and leaf-bases, each caudex branch terminated by a dense tuft of leaves and frequently a flowering head, the plants up to 4 cm high and forming mats up to 10 cm across; leaves linear to narrowly oblanceolate, entire, the apex acute, mucronate, densely strigose-sericeous on both surfaces, involute, 2.5-4 cm long, 1-2 mm wide, the

leaf-blades tapering to the leaf-base, these densely strigose with numerous long white hairs; peduncles lacking, the heads embedded in and surpassed by the leaves; involucre obconical-campanulate, 9-14 mm wide, 9-13 mm high; phyllaries in 5-7 series, linear or nearly so, acute to acuminate at the apex, terminated by a projection of few to numerous long tangled cilia (tufted in some), the marginal ciliate scarious and much shorter, pilose-strigose on the abaxial surface, green below becoming purplish above often along the midvein for some distance downward in most, 5-10 mm long, 0.6-1.2 mm wide, the inner ones the longest; ray-florets 13-34; ray-corollas white on the adaxial surface and cream or occasionally pink on the abaxial surface, glabrous, the rays 6-9 mm long, 1-1.9 mm wide, the tubes 2.5-4 mm long, dark pink to \pm brownish; disk-corollas yellow, sometimes tinged with pink or purple, 4.5-6 mm long; achenes oblanceolate, compressed, 2-ribbed, pubescent with long, fine glochidiate hairs, often papillose on the margins, 3.5-4.5 mm long, 1-1.5 mm wide; pappus of the ray-corollas variable, of very short plurisetose bristles 1-1.5 mm long, sometimes both on the same achene; pappus of the disk-corollas of 15-30 plurisetose barbellate bristles 5.5-8.5 mm long and free. $2n=18$ (Beaman, 1957).

DISTRIBUTION: Widely scattered from the southern Yukon southward into central Colorado in the Rocky Mountains, and sporadically elsewhere as into Utah, eastern Montana, Wyoming, and western South Dakota. Flowering from May to July.

SPECIMENS EXAMINED: Carbon Co.: Scofield, 24 Jun 1904, *Jones s.n.* (POM). Daggett Co.: N slope of the Uinta Mts., Jul 1959, *Richens 38* (UTC). Duchesne Co.: benches of the Uintas near Duchesne, 13 May 1908, *Jones s.n.* (POM).

Townsendia hookeri is presently known in the state from only three widely scattered stations. The Hooker *Townsendia* is closely related to *T. exscapa* and the two can be separated only with some difficulty even in Utah. However, as the two species are geographically separated in Utah, with *T. hookeri* restricted to northeastern Utah and *T. exscapa* known only from central Utah, their distinctiveness is clear at least from a geographical point-of-view. Morphologically the caudices of *T. hookeri* are densely but evenly covered with the matted pubescence of the old leaf-bases so that the stems appear smooth. In *T. exscapa*, the matted pubescence is lacking or nearly so. The leaves of both are similar, but those of *T. hookeri* are decidedly narrower, as are the phyllaries. One easily noted taxonomic feature is the disk-pappus length. The pappus of *T. exscapa* is much longer than the corollas, whereas in the other species the pappus barely exceeds the length of the corollas.

In general the plants of *Townsendia hookeri* are predominantly apomictic. According to Beaman (1957), only the plants from the Front Ranges of Colorado and adjacent southeastern Wyoming are sexual. It is likely, therefore, that the similarity between our three known populations is tenuous, and one must be aware of the overall

range of variation of the species in order to associate these scattered populations with a single entity.

8. TOWNSENDIA EXSCAPA (Richards.) Porter

Aster? *exscapa* Richards. in Frankl., J. Bot. App. 748. 1823

Townsendia sericea Hook., Fl. Bor.-Am. 2: 16. 1834, a new name for *A. exscapa*. *T. exscapa* (Richards.) Porter, Mem. Torrey Bot. Club 5: 321. 1894. Type: Carleton House, Saskatchewan, Canada, *Richardson s.n.* Holotype, K. Photographs in Larsen (1927) and Beaman (1957).

Townsendia sericea Hook. var. *papposa* A. Gray, Mem. Amer. Acad. 4: 69. 1849. Type: Arid hillsides near Santa Fe. Santa Fe Co., New Mexico, Apr-May 1847, *Fendler 349*. Holotype, GH! Isotypes, NY, PH, UC, US!

Townsendia wilcoxiana Wood, Bull. Torrey Bot. Club 6: 163. 1877. *T. exscapa* var. *wilcoxiana* (Wood) A. Nels. in Coult. & Nels. Man. Bot. Rocky Mts. 510. 1909. Type: Camp Supply, Woodward Co., Oklahoma, Mar 1877, *Wilcox s.n.* Holotype, US!

Townsendia intermedia Rydb. in Britt., Man. Pl. Northeast, U.S. 944. 1901. Type: Praire, Trego Co., Kansas, 1896. *Rich 718*. Holotype, NY! Isotypes, GH, MO, RM, US!

Rosulate and nearly pulvinate perennial herbs with several short, rarely elongated, subterranean, woody caudices from a woody taproot, the caudices glabrous or nearly so, not covered with old leaf-bases, the plants up to 3 cm high and 8 cm across; leaves oblanceolate, often narrowly so, entire, the apex acute, mucronate, thinly strigose on both surfaces, not obviously involute, 2.5-5 cm long, 2-3.5 mm wide, with conspicuous midveins, the leaf-blades tapering to the leaf-bases, these strigose; peduncles lacking; involucre campanulate, 1.5-3 cm wide, 1-1.8 cm high; phyllaries in 4-7 series, linear to narrowly lanceolate, acute at the apex, with ciliated scarious margins and apices, glabrous or nearly so on both surfaces, 4-12 mm long, 1-2.3 mm wide, the inner ones the longest; ray-flor-ets 21-40; ray-corollas white or pinkish, often with a darker pink streak on the abaxial surface, glabrous, the rays 8-15 mm long, 1.2-3 mm wide, the tubes 3-5.5 mm long, whitish; disk-corollas yellow, usually purplish (rarely pinkish) tinged at the apex, 6-10 mm long; achenes oblanceolate, compressed, 2-ribbed, those of the rays rarely 3-ribbed, usually heavily pubescent with long glochidiate hairs, 3.5-6 mm long, 1-2 mm wide; pappus of the ray-corollas of 20-30 slender plurisetose, barbellate bristles, 4-8 (10) mm long; pappus of the disk-corollas of 20-45 similar bristles, only 6-12 mm long. $2n=18$ (Beaman, 1957).

DISTRIBUTION: Widespread from southern Canada to northern Mexico, and from extreme eastern Nevada to the Great Plains; infrequently found in south-central Utah at high elevations. Flowering from April to July.

REPRESENTATIVE SPECIMENS: Garfield Co.: E slope of Boulder Mts., 22 Jun 1938, *Beck s.n.* (BRY); near Posy Lake, Aquarius Plateau, 1 Jul 1938, *Beck s.n.* (BRY); Bryce Canyon, 19 Jun 1933, *Eastwood & Howell 769*, in part (CAS); Bryce Canyon, 30 Jun 1923, *Rodda s.n.* (CAS); Bryce Canyon, 11 May 1934, *Stone 256* (NY); Wildcat Ranger Station, Aquarius Plateau, 19 May 1956, *Vickery 611* (UT). Wayne Co.: Near Fremont, 5 Apr 1934, *Harrison 7365* (BRY).

Townsendia exscapa, the first species to be described in the genus, is found from southern Canada to northern Mexico, and most frequently on the Great Plains. In Utah, the species is found only in the Bryce Canyon area and on the Aquarius Plateau where it is infrequently encountered. These plants are easily recognized (at least in Utah) by the long pappus of the disk-corollas and by their distribution at high elevations in the southern part of the state. Like *T. montana*, *T. exscapa* is extremely polymorphic, but in our state, the variation is not extensive although our plants are likely totally apomictic in nature.

9. TOWNSENDIA FLORIFER (Hook.) A. Gray

Erigeron ?florifer Hook., Fl. Bor.-Am. 2: 20. 1834. *Aplopappus* [sic., now *Haplopappus*] *florifer* (Hook.) Hook. & Arn., Bot. Beechey Voy. 351. 1840. *Stenotus florifer* (Hook.) Torr. & Gray, Fl. N. Am. 2: 238. 1842. *Townsendia florifer* (Hook.) A. Gray, Proc. Amer. Acad. 16: 84. 1880. Type: Priest's Rapids of the Columbia River, Kittitas or Grant cos., Washington *Douglas s.n.* Holotype, K.

Townsendia watsonii A. Gray, Proc. Amer. Acad. 16: 84. 1880. *T. florifer* var. *watsonii* (A. Gray) Cronq., Leafl. West. Bot. 6: 49. 1950. Type: Stansbury Island, Tooele Co., Utah, 1869, *Watson 520*. Holotype, GH! Isotypes, US, YU!

Townsendia scapigera D. C. Eat. in Wats. var. *ambigua* A. Gray, Proc. Amer. Acad. 16: 84. 1880. *T. ambigua* (A. Gray) Rydb., Fl. Rocky Mt. 874, 1067. 1917. Type: Rabbit Valley, near Teasdale, Wayne Co., Utah, 6 Aug 1875, *Ward 523*. Holotype, GH! Isotype, US!

Townsendia florifer (Hook.) A. Gray var. *communis* M. E. Jones, Proc. Cal. Acad. Sci. 5: 697. 1895. Type: Marysvale, Piute Co., Utah, 31 May 1894, *Jones 5323*. Lectotype, POM! Isotypes, F, MO, MSC, US!

Causcous winter annual or biennial herbs with ascending-suberect, branched, strigose-hirsute stems from a taproot, up to 1.5 dm high; leaves basal and cauline, the basal leaves spatulate, entire, obtuse or acute at the apex, occasionally mucronate, strigose on both surfaces often more densely so above than below, the leaf-blades and petioles 2-5.5 cm long, the leaf-blades 3-8 mm wide, tapering imperceptibly into the petiole, this anthocynsis at the base, the cauline leaves oblanceolate, spatulate or linear, strigose.

1-4 cm long, 0.7-3.8 mm wide; heads terminating the stems; involucre campanulate, 1.5-3 cm wide, 6.5-13 mm high; phyllaries in 3-4 series, lanceolate, acute, with ciliate or lacerate-ciliated scarious margins, strigose on the outer surface, 4-12 mm long, 1-2.5 mm wide; ray-florets 13-34; ray-corollas white or pinkish, often with a darker pink streak abaxially, frequently glandular on the abaxial surface, the rays 7-12 mm long, 1.5-3 mm wide; disk-corollas yellow, frequently tipped or tinged with pink, 3.3-6 mm long; achenes oblanceolate to narrowly obovate, compressed, 2-ribbed, those of the rays rarely 3-ribbed, densely pubescent with bifurcated unequally forked hairs with the prongs not recurved, papillose, 3.3-4.5 mm long, 1-2 mm wide; pappus of the ray-corollas of 20-30 plurisetose, barbellate or ciliate, bristles, 2-6 mm long, or of short squamellae less than 2 mm long; pappus of the disk-corollas of 20-40 bristles similar to those of the rays only 3.5-7.5 mm long and slightly exceeding the length of the disk-corollas. $2n = 18$ (Beaman, 1954).

DISTRIBUTION: Eastern Washington and Oregon southward across southern Idaho into extreme eastern Nevada and western and south-central Utah mainly on sandy soils. Flowering from April to July.

REPRESENTATIVE SPECIMENS: Beaver Co.: Near Frisco, 19 Apr 1930, *Cottam 4636* (BRY, UC). Box Elder Co.: 20 mi N of Lucien, 9 May 1942, *Maguire & Holmgren 21518* (GH, MO, NY, PH, UTC, WS, WTU). Garfield Co.: 10 mi S of Coyote, 29 May 1894, *Jones 5315b* (US). Juab Co.: 2 mi E of Troutcreek, 18 Jun 1933, *Maguire & Becraft 2829* (GH, UTC); Thomas Range, 9 May 1968, *Reveal & Thomas 981* (BRY, US). Millard Co.: Pruess Lake, 2 May 1964, *Frischknecht 166* (BRY); 20 mi S and 11 mi W of Delta, 5 May 1941, *Harrison 10156* (BRY, NA); near Desert Range Experiment Station Headquarters, 11 May 1965, *R. Holmgren 451* (BRY); 37 mi W of Delta, 15 Jun 1933, *Maguire & Becraft 2830* (POM, UC, UTC); Warm Point, 19 Jun 1941, *Maguire 20880* (GH, NY, UTC); E slope of Cricket Mts., 5 Apr 1968, *Welsh 6789* (BRY). Sanpete Co.: N of Gunnison, 1 Jun 1944, *Cottam 9392* (UT); 7 mi W of Fayette, 12 May 1962, *Jensen 539* (UTC). Sevier Co.: Joseph City, *Jones 6379* (MO, POM, US). Tooele Co.: Cedar Mts., 25 Jun 1953, *Flowers s.n.* (UT); Stansbury Island, 16 Jul 1945, *Garrett 8780* (NA, UT); Gold Hill, 6 Jun 1917, *Jones s.n.* (POM); Simpson Buttes, Dugway Valley, 4 May 1952, *Smith s.n.* (UT); near Wendenover, 8 Jun 1930, *Van Dyke s.n.* (CAS); Onaqui Mts., near Willow Spring, 15 Apr 1968, *Welsh 6876* (BRY). Utah Co.: Goshen, 20 Jul 1928, *Garrett 3955* (UT); Mercur, Jun 1896, *Jones s.n.* (POM).

Townsendia florifer is a sharply defined species in Utah and can be recognized with ease, especially in the sandy parts of western Utah where it is so common. In the field, the suberect stems and often large and showy flowering heads can be spotted without difficulty, although it is often necessary to search among the shrubs and in otherwise protected areas for the plants. It is not known

whether this is due to some ecological factor or to grazing pressures exerted by the numerous winter ranging sheep.

Beaman (1957) reports that *Townsendia florifer* is closely related to and forms hybrids with *T. parryi* D. S. Eat. in Parry, a species found north of Utah. However, in our region, the species is more likely to be confused with *T. scapigera* D. C. Eat. in Wats., an entity not yet known from Utah. The range of *T. scapigera* extends from southeastern California northeastwardly to Elko and White Pine counties in Nevada, but no plants have been seen from Utah. The species is to be expected in Box Elder or Tooele counties, and may be distinguished from *T. florifer* as follows:

- A. Plants caespitose biennial or short-lived perennial herbs; heads clearly pedunculated; phyllaries in 3-4 series, strigose or pilose on the outer surface; cauline leaves few. *T. scapigera*
- AA. Plants winter annual or biennial herbs; heads terminal on the stems; phyllaries in 3-4 series, strigose on the outer surface; cauline leaves numerous. *T. florifer*

10. TOWNSENDIA INCANA Nutt.

Townsendia incana Nutt., Trans. Am. Phil. Soc. 7: 305. 1840. Type: "On the Black Hills, (an alpine chain toward the sources of the Platte [River].)," possibly from near the Wind River Mts. in Wyoming, collected in late Apr 1834, *Nuttall s.n.* Holotype, BM. Isotypes GH, PH!

Townsendia fremontii Torr. & Gray, Bost. J. Nat. Hist. 5: 106. 1845. Type: Wyoming, probably near the Wind River Mts., [Aug ?] 1842, *Fremont s.n.* Lectotype, GH! selected by Beaman (1957).

Townsendia arizonica A. Gray, Proc. Amer. Acad. 16: 85. 1880. Type: Trumbull, Mohave Co., Arizona, 1877, *Palmer 204*. Lectotype, GH! Isotypes, MO, NY, US!, selected by Beaman (1957).

Townsendia incana Nutt. var. *ambigua* M. E. Jones, Zoe 4: 264, 1893. Type: Thompson Springs. Grand Co., Utah, 7 May 1891, *Jones s.n.* Lectotype, POM!, selected by Larsen (1927).

Townsendia dicersa Osterh., Bull. Torrey Bot. Club 55: 75. 1928. Type: Hills south of Grand Junction, Mesa Co., Colorado, *Osterhout 6116*. Holotype, RM.

Pulvinate or suberect perennial (rarely biennial) herbs from much branched, sometimes subterranean, woody caudices arising from thin to stoutish taproots, the caudices often above ground so as to give the plants a caulescent appearance, these stems conspicuously canescent with dense white strigose hairs, the thin stems sometimes long and much-branched; leaves narrowly spatulate to oblanceolate, entire, the apices acutish, macronate, moderately to densely strigose on both surfaces, occasionally more so above than below, the leaf-blades 15-40 mm long, 1.5-5 mm wide, tapering interseptably

into the pedicel; heads mostly terminal on the stems, infrequently pedunculate; involucre campanulate, 8-16 mm wide, 7-11 mm high; phyllaries in 3-4 (rarely 5-) series, mostly lanceolate, the apices acute, with scarious and lacerate-ciliated margins, strigose on the outer surfaces, 3-10 mm long, 1-3.5 mm wide; ray-florets 13-34; ray-corollas mostly white on the adaxial surface and often with an abaxial median pink stripe, or lavender on both surfaces, the rays 6-10 mm long, 1.5-3 mm wide, the tubes 2.5-4 mm long; disk-corollas yellow and often tinged pinkish, 3.5-6 mm long; achenes oblanceolate, compressed, 2-ribbed, pubescent with glochidiate hairs, 2.5-4.5 mm long, 1-1.8 mm wide; pappus of the rays of 15-30 plurisetose, barbellate bristles, 0.3-0.6 mm long, often different lengths on the same achene; pappus of the disk-corollas of 15-35 plurisetose, barbellate bristles, 4-7.5 mm long. $2n = 18$ (Beaman, 1954).

DISTRIBUTION: Central Wyoming south through eastern and southern Utah into western Colorado, northwestern New Mexico, northern Arizona, and southern Nevada. Flowering from (April) May to July (November).

REPRESENTATIVE SPECIES: Without definite location: Southern Utah, 1877, *Palmer 204* (US); southern Utah, 1874, *Siler s.n.* (GH); southern Utah, 1872, *Thompson s.n.* (US). Beaver Co.: Milford, 19 Jun 1880, *Jones 1794* (MSC, MO, NY, PH, POM, US, UTC, WS). Carbon Co.: near Price, 2 and 12 May 1927, *Flowers s.n.* (UT); Castle Gate, 22 Sep 1888, *Jones s.n.* (POM); Sunnyside, 15 Nov 1907, *Jones s.n.* (POM); 3 mi S of Price, 9 May 1940, *Maguire & Maguire 18269* (UTC). Daggett Co.: Hideout Forest Camp, 26 Jul 1959, *Flowers et al. 188* (UT); 12 mi S of Manila, 7 Jul 1938, *Hitchcock et al. 3913* (DS, NA, WTU); near Flaming Gorge, 31 May 1932, *Williams 470* (MO., NY, UTC). Duchesne Co.: 5 mi W of Duchesne, 26 Jul 1957, *Beaman & Stone 1448* (MSC); 18 mi W of Duchesne, 5 Jul 1947, *Ferris 11310-A* (DS); Randelet, 22 May 1908, *Jones s.n.* (POM); 3 mi E of Fruitland, 30 May 1942, *Ripley & Barneby 4659* (NY). Emery Co.: Temple Mt., 1 Jun 1962, *Allman s.n.* (BRY); 3-6 mi N of San Rafael Bridge along Utah Hwy. 24, 30 Apr 1963, *Barnett et al. 34* (BRY); Buckhorn Wash, 13 May 1955, *Flowers s.n.* (UT); Huntington Canyon, 21 Jul 1935, *Garrett 7024* (NA, UT); 20 mi SW of Green River, 15 May 1931, *Harrison 5590* (BRY); 0.5 mi N of San Rafael Bridge, 17 Jun 1948, *Holmgren et al. 7768* (NY, UTC); Woodside, 2 Jul 1898, *Jones s.n.* (MO, POM, US); 20 mi E of Hanksville, 8 May 1940, *Maguire & Maguire 18212* (UTC); Calf Springs Canyon, *Maguire & Maguire 18303* (GH, NY, US, UTC, WS). Garfield Co.: between Henrieville and Upper Valley, 21 Jun 1957, *Cottam 14666* (UT); S of Calf Canyon, 2 Sep 1963, *Cottam 17752* (UT); 10 mi S of Boulder, 11 May 1965, *Cronquist 10076* (BRY, NY, UTC); 8 mi SE of Escalante, 25 Jun 1965, *N. H. Holmgren et al. 2030* (BRY, NY, UTC); 20 mi SE of Escalante, 26 Jun 1965, *N. H. Holmgren 2048* (BRY, NY, UTC); canyons above Tropic, 28 May 1894, *Jones 5312t* (POM); Crescent Creek, Henry Mts., no date, *Stanton 487* (BRY); Bryce Canyon, 9

Jun 1931. *Weight B-3114* (US, UT); Eggnog Spring, Bullfrog Creek, 6 May 1965, *Welsh 4001* (BRY). Grand Co.: 1.4 mi W of Crescent Junction. 14 Jul 1954, *Beaman 804* (GH, MSC, UTC); 3 mi W of Dead Horse Point. 26 May 1950, *Cottam 12118* (UT); 16 mi NW of Moab. 22 May 1961, *Cronquist 9067* (NY, UTC); 16 mi SE of Thompson. 11 Jun 1961, *Cronquist & Holmgren 9247* (NY, UTC); above Courthouse Towers. 16 May 1949, *Harrison 11374* (BRY); Westwater. 28 Jun 1898, *Jones s.n.* (POM); Thompson Springs. 1899, *Purpus 6465* (MO, POM, UC, US); Moab, 1-2 Jul 1911, *Rydberg & Garrett 8444* (NY, UC); ca. 32.5 mi from Moab along the Colorado River, along Utah Hwy. 124, 3 May 1968, *Welsh 6994* (BRY); E end of Castle Valley, 3 May 1968, *Welsh 7009* (BRY). Iron Co.: Cedar Canyon, 9 May 1936, *Cottam 6729* (UT); Cedar City, 1874, *Parry 94* (GH, MO); Cedar City, 11 May 1919, *Tidestrom 9431* (US). Kane Co.: 0.6 mi E of the E entrance to Zion Natl. Park. 20 Jul 1954, *Beaman 827* (GH, MSC); base of Checkerboard Mesa, Zion Natl. Park, 27 Jun 1938, *Boyle 7215* (UC); 4 mi S of Cannonville, 12 May 1965, *Cronquist 10082* (BRY, NY, UTC); 1 mi W of Glen Canyon City. 22 May 1965, *Cronquist 10156* (BRY, NY, UTC); 2 mi NNW of Kanab, 6 Aug 1945, *Hester 1016* (NA); 15 mi NW of Orderville, 15 Jun 1940, *Maguire 18863* (NY); Cockscomb Ridge, 6 May 1966, *Welsh 5345* (BRY). Piute Co.: Marysvale. 1 Jun 1894, *Jones 5455q* (US). Sevier Co.: Near Belknap. 10 June 1900, *Stokes s.n.* (DS, NY, US); Richfield, 5 Jun 1875, *Ward 176* (GH, MO, PH, US). San Juan Co.: Comb Wash. 5 May 1961, *Cronquist 8965* (NY); Four Corners, 10 Jun 1940, *Cutler 3341* (NA, US); 10 mi SW of Blanding. 8 May 1933, *Harrison 5940* (UC, UTC); Bluff, 12 May 1944, *Holmgren 3183* (NY, UTC); SW of Abajo Mts., 10 Aug 1911, *Rydberg & Garrett 9596* (NY, UT); White Canyon, 17 Aug 1963, *Welsh & Moore 2517* (BRY, NY). Uintah Co.: Ca. 35 mi S of Ouray. Jun 1955, *Bartholomew & Bartholomew s.n.* (GH); 5 mi NW of Whiterock, 28 May 1966, *Brotherson 1024* (BRY); Island Park, 15 May 1933, *Graham 7563* (MO, NA); 3 mi NW of Vernal, 25 Jun 1967, *Higgins 1077* (BRY); 1 mi W of Rainbow. 4 Jun 1965, *N. H. Holmgren et al. 1805* (BRY, NY, UTC-mixed with *T. Strigosa*); 5 mi S of Vernal. 30 May 1950, *Norris 5* (UTC); 14 miles N of Bonanza, 12 Jun 1968, *Atwood 1547*. Wayne Co.: 8 mi SE of Fruita, 25 May 1940, *Carter 1552* (UC); Torrey, 27 May 1944, *Cottam 1336* (UT); Standing Rock area, Canyonlands Natl. Park, 30 May 1964, *Cottam 17783* (UT); 5 mi S of Hanksville, 17 May 1950, *Harrison 11536* (BRY, US); Marvine Laccolite, 23 Jul 1894, *Jones 5663ac* (US); 10 mi S of Fruita, 5 Jun 1953, *McVaugh 14453* (CAS, NY); 12 mi E of Fruita, 1 Jul 1940, *Maguire 19294* (NY); 2 mi W of the jct. of Utah Hwy. 117 and the road S from Torrey, 26 May 1968, *Reveal & Reveal 1046* (BRY, US); 1 mi W of Bicknell, 19 May 1956, *Vickery 607* (UT).

Townsendia incana is our most common member of the genus as well as one of the more polymorphic. It is found in numerous eco-

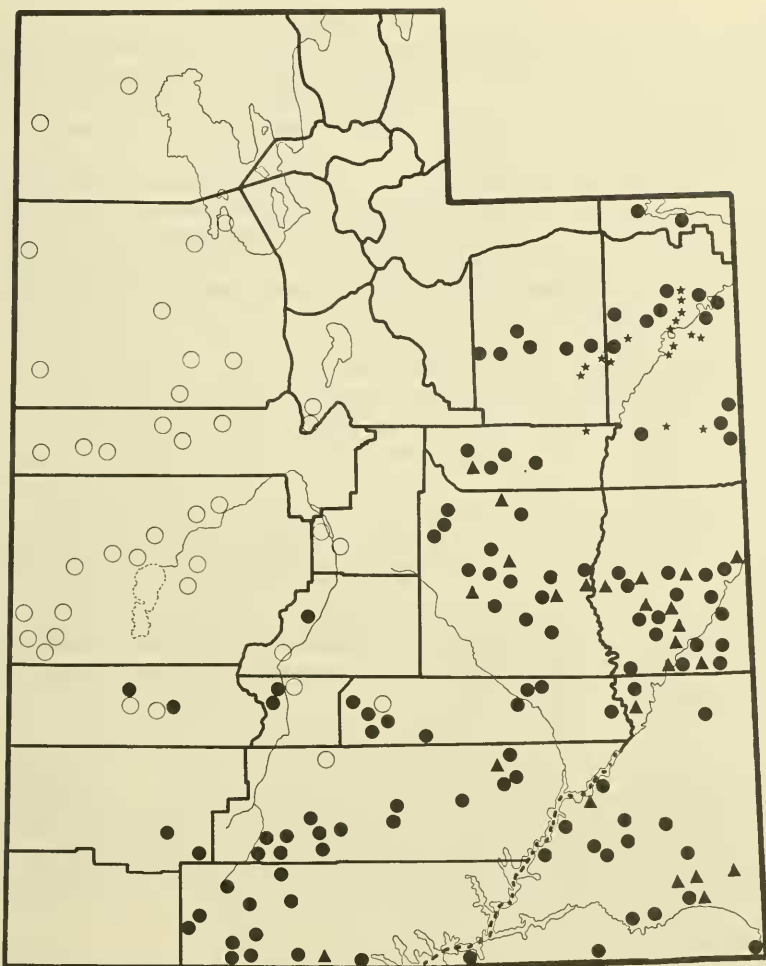


Fig. 2. Distribution of *Townsendia florifer* (open circles); *T. incana* (closed circles); *T. strigosa* (stars); and *T. annua* (triangles).

logical niches ranging from hard clay slopes to loose sandy areas and the edges of steep cliffs. In Utah, the species is found primarily in the eastern and southern portions of the state and thus well isolated from such other species as *T. jonesii* and *T. florifer* with which it can be confused on occasions. In this study, nearly all plants seen from the state appear to be perennial; some from Grand County may be biennial, but they are rare and infrequently collected. The degree of compaction of the plants vary. In San Juan, Kane, Grand, and parts of adjacent counties, the plants tend to be more elongated and less pulvinate. This in part seems to be due to their ecological

niche as most of the plants in this area occur in sandy soils. Some plants from Wayne, Garfield, Kane and other counties in the southwestern part of Utah tend to be more pulvinate. Those of gumbo clay slopes in Wayne Co., for example, tend to verge into *T. jonesii* and *T. aprica* in this respect and care must be taken in identifying specimens from there.

In much of southeastern Utah, the ranges of *Townsendia incana* and *T. annua* overlap. Some plants from San Juan Co. were reported by Beaman (1957) to be intermediate between the two, and apparently some hybridization has led to an overlapping of pappus characteristics. It is equally likely that *T. incana* may also form hybrids with *T. strigosa* in the northeastern part of the state where their ranges come together. Beaman (1957) pointed out the difficulties of differentiating hybrids between the two due to the polymorphic nature of *T. incana*, and no new information has come to light during this study. That the two grow together can be attested by the number of mixed collections from Grand and Uintah counties.

Nevertheless, *Townsendia incana* is rather distinct and easily recognized by the densely pubescent (usually canescent) lower stems. This condition is not seen in either *T. annua* or *T. strigosa*, and except for very depauperate specimens, this feature is easily seen. The problem of hybridization is not acute either for that matter, especially since most of the plants of *T. incana* in Utah are apomictic in Utah, and aside from a few sexual populations in the southeastern part of the state, there is no great concentration of available genes for any active hybrid swarms.

11. TOWNSENDIA STRIGOSA Nutt.

Townsendia strigosa Nutt., Trans. Am. Phil. Soc. 7: 306. 1840. Type: "On the Balck Hills, (or eastern chain of the Rocky Mountains.) near the banks of the Platte [River].", probably near the banks of the Sweetwater River in the vicinity of the Wind River Mts., Wyoming, probably Apr 1834, *Nuttall s.n.* Holotype, BM. Isotypes, GH, PH!

Townsendia incana Nutt., var. *prolixa* M. E. Jones, Contr. West. Bot. 13: 15. 1910. Type: Chepeta Well, Uintah Co., Utah, 23 May 1908, *Jones s.n.* Holotype, POM! Isotype, POM!

Cauliscent biennial herbs from a thin taproot with the root-stem junction enlarged, the stems branched at the base with few to many branches, these branched again slightly below the heads in a cymose manner, the plants mostly spreading-suberect, up to 2 dm long; leaves basal and cauline, the basal leaves persistent, oblanceolate to spatulate, entire, the apices acutish, mucronate, lightly to moderately strigose on both surfaces, the leaf-blades 5-15 mm long, 3-6 mm long; achenes oblanceolate, compressed, 2-ribbed, those of the cauline leaves similar to the basal ones only smaller and often clustered immediately below and overtopping the fastigiate heads, the blades up to 2 cm long and 1-3 mm wide, tapering gradually to the

stems, the stems often reddish with the strigose hairs appressed-erect; heads terminal; involucre campanulate. 7-13 mm wide, 5-8 mm high; phyllaries in a 3-4 series, elliptic, ovate or lanceolate, the apices acute, with broad scarious or lacerate-ciliate margins, 3-7 mm long the 1.2-1.9 mm wide, the outer series moderately strigose on the abaxial surface, the longer inner ones only slightly if at all pubescent near the mid-axis and the apices; ray-florets 13-34; ray-corollas white to pink, occasionally darker at the base or with a longitudinal darker cream to pink streak on the abaxial surface, the rays 6-11 mm long, 1.3-3 mm wide, the tubes 2-3.2 mm long, greenish; disk-corollas yellow, occasionally mottled with pink in some, 3.5-5 mm long; achenes oblanceolate, compressed, 2-ribbed, those of the rays rarely 3-ribbed, moderately pubescent with glochidiate hairs, 3-4 mm long, 0.8-1.3 mm wide; pappus of the rays short, plurisetose, barbellate bristles mostly connate at the base, 0.6-1.2 mm long; pappus of the disk-corollas of 20-35 plurisetose, barbellate bristles, 3-4.8 mm long, mostly equalling or slightly exceeding the length of the disk-corollas.

DISTRIBUTION: Southwestern Wyoming south into extreme northwestern Colorado and northeastern Utah, often on heavy clay or sandstone soils. Flowering from May to June.

REPRESENTATIVE SPECIMENS: Carbon Co.: Nine Mile Canyon, 22 May 1896, *Jones s.n.* (POM). Duchesne Co.: 15 mi SW of Myton, 28 May 1966, *Brotherson 1089* (BRY); 10 mi SE of Myton, 26 May 1933, *Graham 7865* (NA, UC); 6 mi SW of Duchesne, 9 Jun 1940, *Harrison 397H* (BRY, US); Duchesne to Myton, 19 May 1908, *Jones s.n.* (POM); Myton, 20 May 1908, *Jones s.n.* (POM). Uintah Co.: 12 mi S of Ouray, 27 May 1966, *Brotherson 1059* (BRY); 5 mi NW of Dinosaur Natl. Mon., 6 May 1933, *Graham 7671* (NA-mixed with *T. incana*); S of the mouth of Sand Wash, 29 May 1933, *Graham 7946* (NA); 1 mi W of Rainbow, 4 Jun 1965, *N. H. Holmgren et. al. 1805* (UTC-mixed with *T. incana*); Randelet, 22 May 1908, *Jones s.n.* (POM); Thorne's Ranch, Big Pack Mt., W of Willow Creek, 15 Jun 1937, *Rollins 1705* (GH, NA, NY).

Townsendia strigosa is restricted to the northeastern corner of Utah where it is locally common, yet only infrequently collected. The plants occur mainly on clay slopes in the Uintah Basin and in better growing season can become a bit weedy, competing with *Eriogonum inflatum* Torr. & Frem. var. *fusiform* (Small) Reveal. The plants do not remain active for long and quickly flower and then become somewhat inconspicuous in the field. Beaman (1957) reports that sheep feed on the plants, and this too must reduce the number of plants somewhat.

This species is closely related to *Townsendia annua* and although the two are allopatric some hybridization likely occurred in the past between the two (Beaman, 1957). Superficially, *T. strigosa* resembles some forms of *T. florifer*, but the two differ in types of

hairs on the achenes, and of course as far as Utah is concerned, in their widely separated geographical distributional patterns.

All known plants of this species in Utah are sexual; no apomictic plants are known in the species save one population in Wyoming.

12. TOWNSENDIA ANNUA Beaman

*Townsendia Annu*a Beaman, Contr. Gray Herb. 183: 132. 1957. Type: Sandy beds of Cottonwood Wash near Wayland's Ranch, 1.5 mi N of Bluff, San Juan Co., Utah, 19 Apr 1936. *Maguire 13509*. Holotype, GH! Isotypes, CAN, PH, UC, UTC, WTU!

Caulicent annual (rarely biennial ?) herbs with few to many prostrate to ascending stems arising from thin taproots, branching at the base and above, 0.2-1.5 dm high, the stems minutely striated and strigose nearly throughout; leaves basal and cauline, the basal leaves short-lived, drying brown or tan but still \pm persistent, oblanceolate to spatulate, entire, the apices mostly acute, occasionally mucronate, lightly strigose on both surfaces but becoming glabrate with age in most, 0.5-1.5 cm long, 1-3 (5) mm wide, the cauline leaves similar to the basal ones only not drying and more persistent, \pm evenly distributed along the stems, appearing clustered at the lower nodes in young plants, not surpassing the expanded heads at maturity; heads terminating the leafy stems on inconspicuous peduncles; involucre campanulate, 6-14 mm wide, 4.5-7 mm high, becoming broadly expanded at maturity; phyllaries in 3, rarely 2- or 4- series, elliptic or more commonly obovate to ovate, the apices obtuse to acute or rarely slightly acuminate, the margins scarious and ciliate especially along the upper margins, 2-6 mm long, 1-2 mm wide, the outer ones strigose-pilose, the longer inner ones nearly or entirely glabrous; ray-florets 13-34; ray-corollas white to pink or lavender, often with a darker pink or lavender longitudinal streak on the abaxial surface, the rays 4-8 mm long, 1-2.3 mm wide, glabrous, the tubes 2.5-3 mm long; disk-corollas yellow, sometimes tinged with pink or purple, 2.2-3.5 mm long; achenes oblanceolate to achenes oblanceolate to obovate, compressed, 2-ribbed, those of the rays rarely 3-ribbed, lightly to moderately pubescent with glochidiate hairs, occasionally papillose especially on the achenes of the rays, 1.9-2.6 mm long, 0.6-1.1 mm wide; pappus of the ray-corollas often of short, plurisetose, barbellate bristles, 0.4-0.8 mm long; pappus of the disk corollas of 15-30 plurisetose, barbellate bristles, 1.8-3 mm long, shorter than the disk tube. $2n = 18$ (Raven et al. 1960).

DISTRIBUTION: Sandy places from east-central Utah and extreme western Colorado south through eastern Arizona and New Mexico into extreme Texas and extreme northern Mexico. Flowering from April to September.

REPRESENTATIVE SPECIMENS: Without definite locality: Denver and Rio Grande Railroad, May 1888. *Shockley s.n.* (UC). Carbon Co.: Price, 15 Oct 1888, *Jones s.n.* (POM). Emery Co.: Green River,

9 May 1890, *Jones s.n.* (MO, MSC, POM, UC, US); Mounds. 9 Jun 1910, *Jones s.n.* (POM). Garfield Co.: Henry Mts., 25 May 1932, *Stanton 1059* (UT). Grand Co.: 5 mi S of Crescent Junction, 15 Jun 1944, *Holmgren & Hansen 3295* (BRY, GH, MO, NY, UC, US, UTC, WS, WTU); Arches Nat'l. Mon., 29 Jun 1948, *Howell 24755* (CAS); Westwater, 20 May 1901, *Jones s.n.* (POM); near Buckhorn Reservoir, 8 Jun 1940, *Maguire 18493* (GH, NY, US, UTC); 4 mi E of Green River, 29 Apr 1965, *Merino 14* (BRY); 12.8 mi SE of Crescent Junction, 4 Jun 1958, *Raven 13075* (NY, UC); near Moab, 1-2 Jul 1911, *Rydberg & Garrett 8441* (NY); 4 mi S of the jct. of Utah Hwy. 24 and U.S. Hwy. 50-6, 3 May 1965, *Welsh 3906* (BRY); Upper Courthouse Wash, Arches Nat'l. Mon., 4 May 1968, *Welsh 7026* (BRY). Kane Co.: 42 mi E of Kanab, 12 May 1953, *Harrison 12079* (BRY). San Juan Co.: 10 mi E of Hite, 15 May 1961, *Cronquist 9026* (NY, UTC); 8 mi N of Bluff, 27 May 1961, *Cronquist 9117* (NY, UTC); Island in the Sky area, 9 Jul 1964, *Moore 236* (BRY); 5 mi W of Hovenweep Nat'l. Mon., 21 Apr 1962, *Wetherell & Finzel 609* (NY).

T. annua from *T. strigosa* is relatively easy. *Townsendia annua* is characterized by the short disk-pappus, achenes, and disk-corollas as well as the deciduous basal leaves. In *T. strigosa*, the disk-pappus is longer than the disk-corolla and has longer achenes, and disk flowers. In addition, the basal leaves of *T. strigosa* are persistent.

Beaman (1957) considered *Townsendia annua* to be strictly an annual. However, in the present, one specimen, (*Merino 14*) is thought to be biennial. It has persistent basal leaves. This specimen likely represents a hybrid between *T. annua* and *T. incana*, but except for this one feature, the plant is typically the annual species. As already noted in the discussion of *T. incana*, most of the populations of this species in Grand Co. are apomictic, and the chances for hybridization are slim. A second possibility is that as this collection of Merino's is on the northern fringe of the range of *T. annua* where adaptation to the biennial habit may be occurring.

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